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JAMES MILLEN MFG. CO., INC.

Instructions for No. 92200

TRANSMATCH

1. GENERAL

The Millen No. 92200 TRANSMATCH is a 2 kw. peak band switching adjustable r.f. transformer with a reflectometer as the indicator. It is a single-ended or unbalanced device intended to match single-ended transmitters to coaxial transmission lines. The purpose of the No. 92200 TRANSMATCH is to convert the impedance of any coaxial fed antenna system to 50 ohms so that at all frequencies the transmitter may work into the impedance for which it was designed.

TRANSMATCH is a generic name coined by the editors of QST to define a device or matching network inserted between a transmitter and a transmission line. The No. 92200 TRANSMATCH is a 2 kw peak commercial version of the 50 ohm network described by Lewis McCoy, W1ICP, in the July 1961 QST.

Nearly all transmitters are built with pi-network tank circuits which are designed to work into a 50 ohm load. If the actual load on the transmitter is other than 50 ohms, the transmitter cannot be loaded properly and the overall operation is not optimum.

Multi-band beam antennas or trapped dipoles are fed with 50 ohm coaxial cable. Unfortunately, no antenna designed to cover a band of frequencies will look like a pure resistance of 50 ohms across the entire band. There will necessarily be a mismatch as frequency is changed within the band. The height of the antenna above ground, its proximity to nearby objects, and its actual impedance at resonance all effect the match between the antenna and the transmission line. The match or mismatch between the antenna and the transmission line determines the impedance that the transmission line presents to the transmitter. When the antenna is not matched into the 50 ohm transmission line, the transmitter load will not be 50 ohms even though 50 ohm coaxial cable is used. This means that the transmitter will not be working into 50 ohms and thus will not do the job for which it was designed. The Millen No. 92200 TRANSMATCH will match the load to the transmitter. The No. 92200 TRANSMATCH also has provision for coupling a Modulation Monitor, such as the Millen No. 90932, to r-f output of the transmitter.

2. IMPEDANCE RANGE

At all amateur frequencies between 3.5 mc and 29.7 mc., the TRANSMATCH will match impedances of 10 ohms up to a relatively high impedance to the 50 to 75 ohm output impedance of the transmitter. The upper impedance which can be matched depends on the frequency in use. The high impedance limits are:

3.5	mc.	1300 ohms
7	mc.	1300 ohms
14	mc.	600 ohms
21	mc.	500 ohms
28	mc.	300 ohms

3. DESCRIPTION

The No. 92200 TRANSMATCH is a desk top cabinet measuring 7 inches high x 14 inches wide x 13⅝ inches deep.

Electrically the TRANSMATCH is a band-switched "L" network with a 50 ohm reflectometer and meter to simplify adjustment.

The "L" network consists of a band-switched inductor in parallel with a split stator variable capacitor and a variable capacitor in series with the output connector. The r-f input from the transmitter is fed through a 50 ohm reflectometer (popularly called a monimatch), to the rotor of the split stator parallel capacitor.

The reflectometer rectifies a sample of the r-f power going out toward the antenna and a sample of the r-f power reflected back. A switch on the front panel allows the operator to read either relative forward power or relative reflected power on the meter on the front panel.

Proper adjustment of the "SERIES" and "PARALLEL" controls on the TRANSMATCH should result in zero reflected power.

A single turn link coil is loosely coupled to the parallel coil and connected to the "MONITOR" jack on the rear to facilitate connection to a modulation monitor oscilloscope requiring low impedance input.

The two large dials on the front panel are labeled "SERIES" and "PARALLEL" to indicate their use in the circuit. This has no connection with series and parallel tuning of impedance feed lines since the TRANSMATCH is designed exclusively for use with coaxial fed antenna systems.

The large dials are marked 0 to 100. This is approximately the per cent of maximum capacity. When the dial is at 0, the capacitor is at minimum

capacity; when the dial is at 100, the capacitor is at maximum capacity.

The large switch in the center of the panel selects the amateur frequency band. This switch taps the coil.

The switch at the lower left of the panel is marked "FORWARD" and "REVERSE". This switch selects the sampled forward and reverse power to be indicated by the meter.

The control at the lower right of the panel is marked "SET". This control is used to set the forward indication at full scale on the meter. It is turned counterclockwise toward "HIGH" when the transmitter power is high and clockwise toward "LOW" when the transmitter is low power.

There are three coaxial connectors on the rear of the TRANSMATCH. The output connector is marked "ANTENNA TRANSMISSION LINE" and the input connector is marked "TRANSMITTER". The center connector is marked "LOW IMPEDANCE PICK-UP FOR MILLEN 90932 MODULATION MONITOR".

4. INSTALLATION

Installation of the TRANSMATCH is very simple. The desk top TRANSMATCH cabinet should be placed on the operating table so the controls may be reset when changing bands. The low impedance r-f output of the transmitter should be connected to the "TRANSMITTER" jack on the TRANSMATCH by means of 50 ohm coaxial cable. The length of the cable is not critical. The coaxial antenna feed line should be connected to the "ANTENNA TRANSMISSION LINE" jack on the rear of the TRANSMATCH. The r-f input jack on the station modulation monitor should be coupled to the center connector on the TRANSMATCH by means of coaxial cable. The installation is now complete.

5. ADJUSTMENT

Initial adjustment is best accomplished on a particular band by disconnecting the antenna and transmitter cables from the TRANSMATCH and connecting them together.

1. Tune and load the transmitter in the normal manner with the TRANSMATCH out of the circuit.
2. Connect the antenna and transmitter cables to the TRANSMATCH.
3. Adjust the "SET" control to "HIGH". This is necessary to avoid damaging the sensitive meter in the TRANSMATCH.
4. Set the "FREQUENCY" switch to the desired operating band.
5. Set the meter selector switch to "FORWARD".
6. Set the "PARALLEL" dial to 29 on the dial, as a starting point.
7. Set the "SERIES" dial to 27 on the dial, as a starting point.
8. Turn on the transmitter. If possible, use reduced power.
9. Adjust the "SET" control for approximately full scale forward power.
10. Set the meter selector switch to "REFLECTED".
11. Adjust both the "PARALLEL" and "SERIES" dials **SLOWLY** and simultaneously or in small steps for approximately zero reflected power.
12. Switch to "FORWARD".
13. Adjust transmitter for maximum forward power, being careful not to exceed transmitter current ratings.
14. Adjust "SET" for exactly full scale forward power.
15. Switch to "REFLECTED".
16. Adjust very carefully both the "PARALLEL" and "SERIES" dials for zero reflected power.
17. Make a note of the exact dial readings so that subsequent adjustment on this band will be greatly simplified.

The TRANSMATCH is now adjusted properly and the antenna is now coupled to the transmitter so that the transmitter is working into the impedance for which it was designed and the transmission line standing wave ratio is 1.0. The actual adjustment of the TRANSMATCH takes considerably less time and effort than reading how to do it.

6. CALIBRATION CURVES

Included in this instruction book are five sets of curves showing typical curves of TRANSMATCH dial readings versus load (line) impedance, assuming 50 ohms transmitter impedance. Each set of curves includes a curve for each end of the amateur frequency band. These curves are useful in estimating the actual load impedance but, more important, give convenient dial readings as "starting points".

7. MARS FREQUENCIES

The TRANSMATCH may be used at the MARS frequencies. Although the range of impedances which can be matched to 50 ohms is reduced, those impedances which one is likely to encounter can be matched.

Table I shows the range of Line impedances which can be matched to 50 ohms versus frequency. This data covers 3.0 to 5.2 mc. with the FREQUENCY switch at 3.5 mc.

Frequency Megacycles	Low Impedance Ohms	High Impedance Ohms
3.00	36	85
3.20	17	185
3.25	15	209
3.30	15	262
3.40	15	475
3.45	15	620
3.50	10	2030
3.75	10	2700
4.00	10	3650
4.25	15	5020
4.50	15	7180
4.60	15	8480
4.70	15	320
4.75	16	267
5.00	24	143
5.20	35	90

Table I

8. TECHNICAL SPECIFICATIONS

Input Impedance (Transmitter)—50 to 75 ohms single-ended.
Output Impedance (Transmission Line)—10 to 300 ohms coaxial. 5 to 1000 ohms at most frequencies.
Frequency Range—3.5, 7, 14, 21, 28 mc. amateur bands bandswitched.
Power Handling Capability—2 KW Peak.
Indicator—50 ohm Reflectometer with meter.

Physical Data
Construction—Desk top cabinet
Height—7 inches
Width—14 inches
Depth—13⅝ inches
Weight—17 pounds
Connectors—SO 239

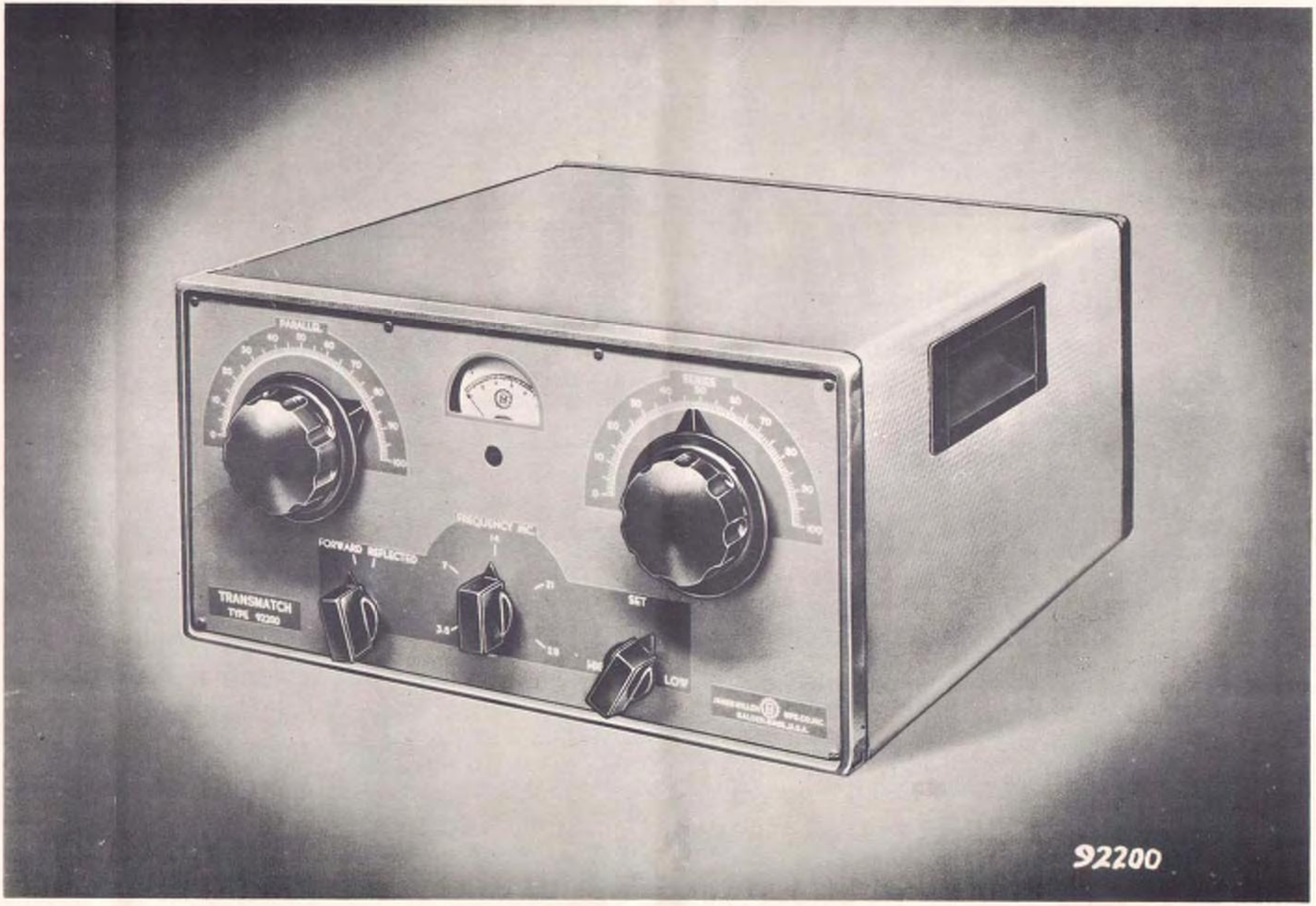
TRANSMATCH

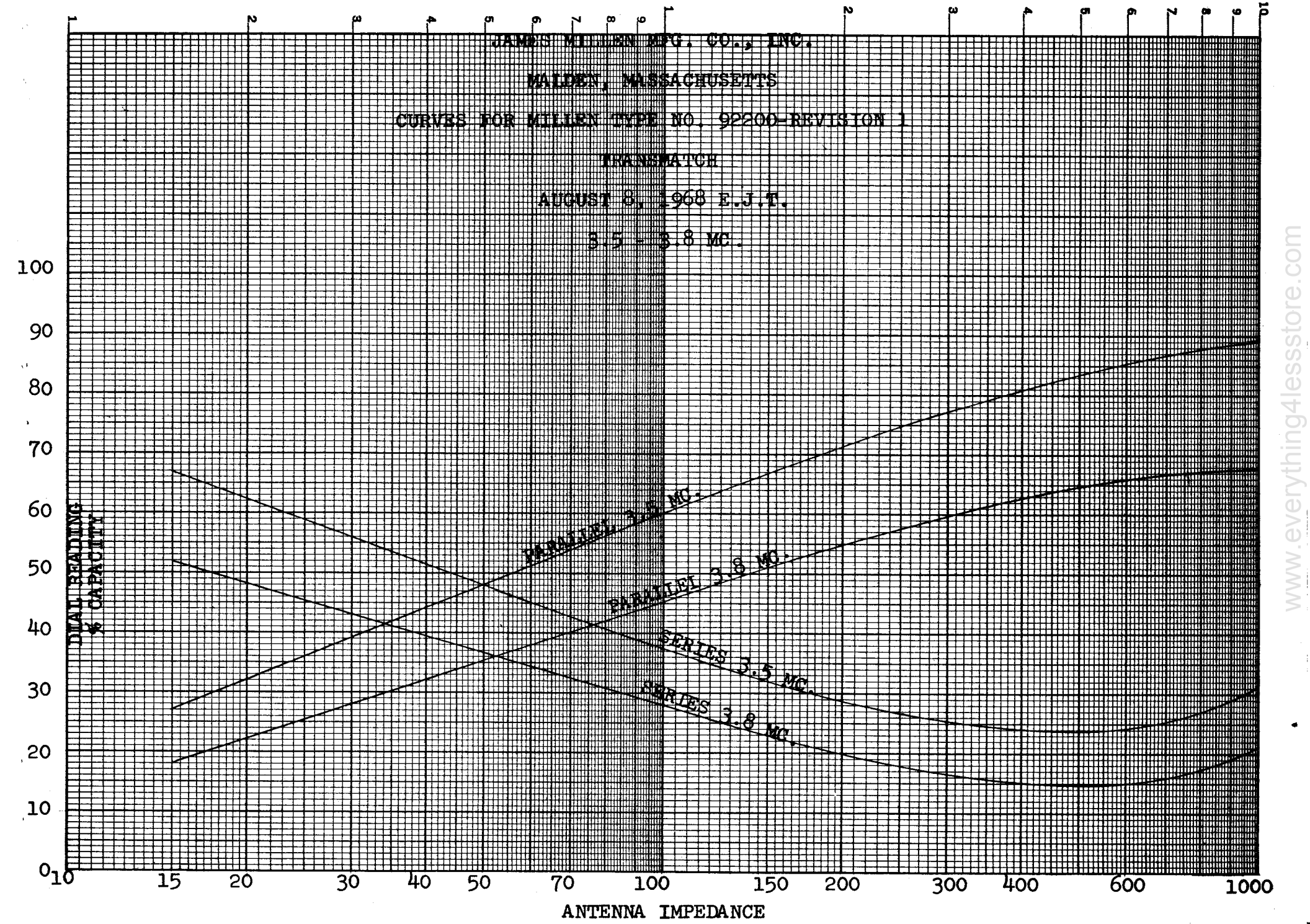
Millen No. 92200

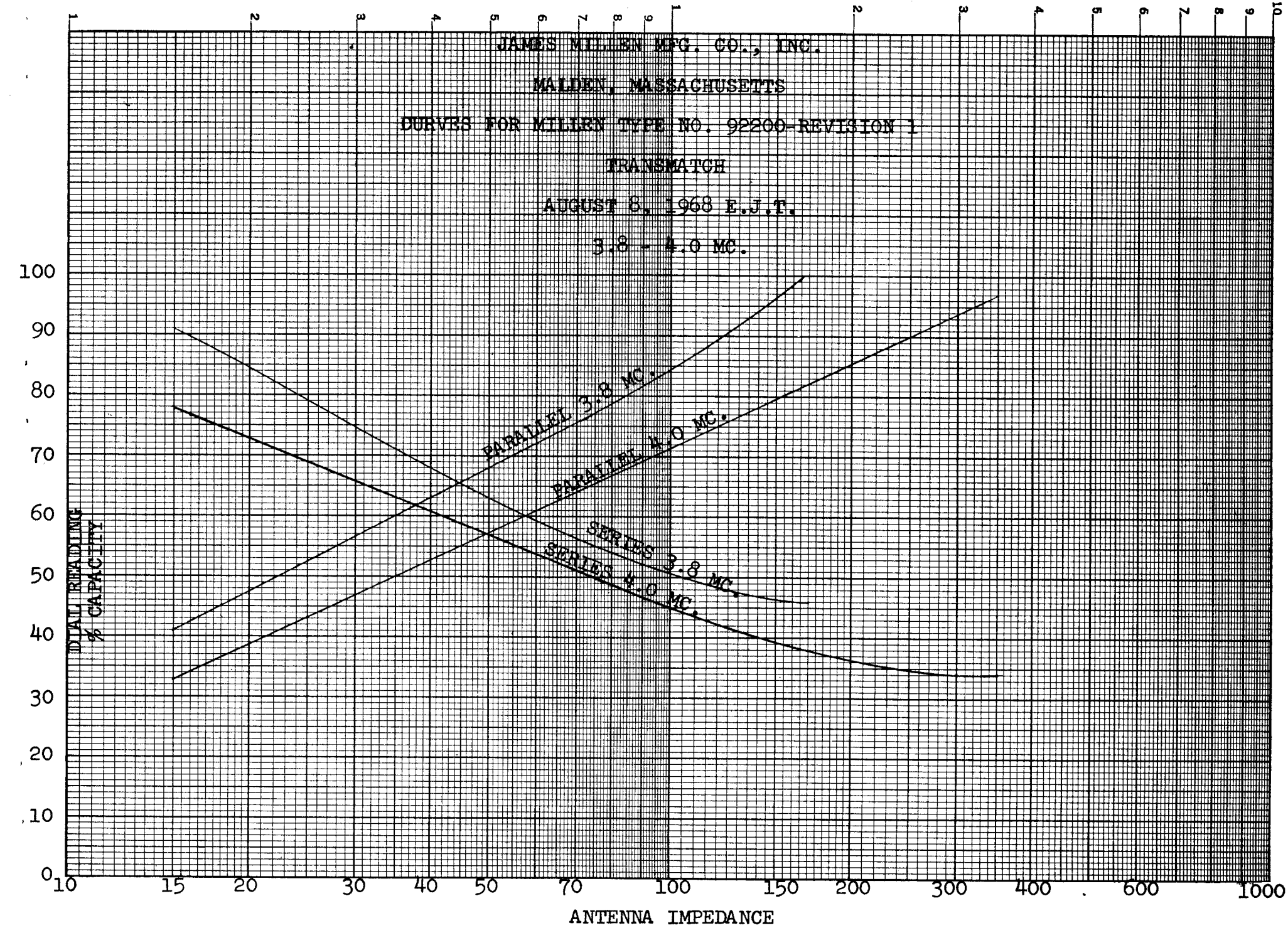
PARTS LIST

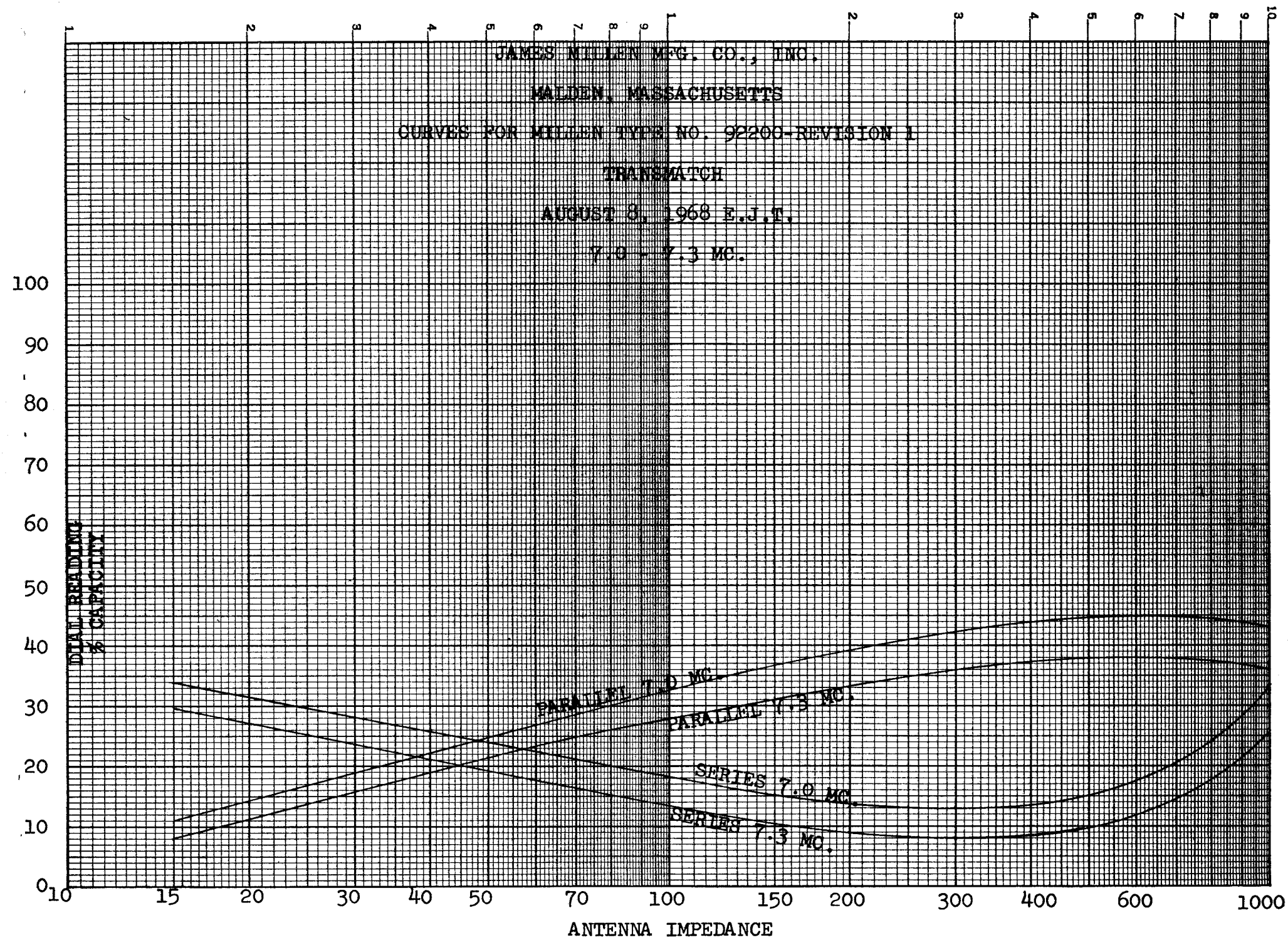
R 1 470 ohm ± 10% ½ watt Composition Resistor—Allen Bradley Type EB
R 2 Same as R 1
R 3 25 K ohm ± 10% ½ Watt Linear Taper Potentiometer
⅜" dia. Bushing ⅜" long-¼" dia. Plain Shaft ⅜" Long from Bushing; IRC—CTS Type PQ
C 1 0.001 mfd. ± 10% 500 V. Ceramic Disc Capacitor
C 2 Same as C 1
C 3 Millen No. 16511-1 9000 V. Single Section Condenser
C 4 Millen No. 16100-1 6000 V. Dual Section Condenser
CR 1 1N34A Germanium Diode—P.I.V: 75 V. I.: 50 Ma.—Erie
CR 2 Same as CR 1
S 1 DPDT Phenolic Rotary Switch—⅜" dia. Bushing ⅜" Long—¼" dia. Shaft ⅜" Long from Bushing
S 2 1 Section 1 Pole 5 Position Ceramic Rotary Switch—6000 V. 20 Amps—Shorting Contacts—30° Detent—Radio Switch Model 86
L 1 Millen 14, 21, 28 mc. 1 KW. Transmatch Coil
L 2 Pick-up Loop to feed Millen No. 90932 Monitor Oscilloscopes
L 3 Millen 3.5, 7 mc. 1 KW. Transmatch Coil
M 1 0-200 microampere G. E. Type DW-51 Model ARF34-1
J 1 Coaxial RF Connector—Amphenol Type 83-1R
J 2 Same as J 1
J 3 Same as J 1
2 Millen No. 10006 2¾" dia. Black Phenolic Knobs with Pointer
3 Millen No. 10002 1⅛" Black Phenolic Bar Knob
8 Millen No. 31012 Steatite Standoffs
2 Millen No. 39032-C Insulated Shaft Coupling
1 Millen No. 92200-12 Meter Shield
1 Millen No. 92200-13 Meter Shield Cover
1 Millen No. 92200-24 Panel
6 Millen No. 92200-11 Coil Mounting Post

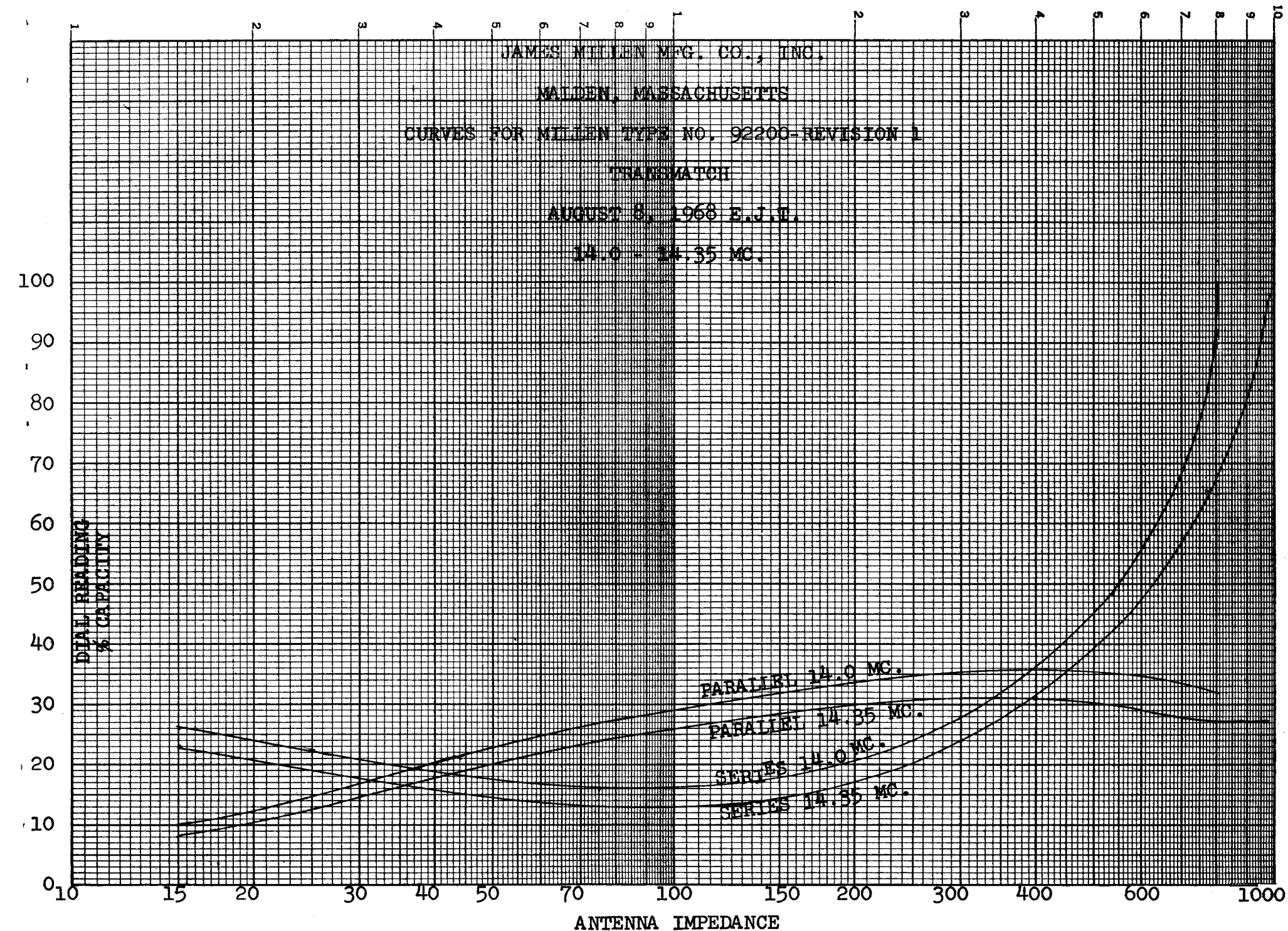
R. W. C. 8/64

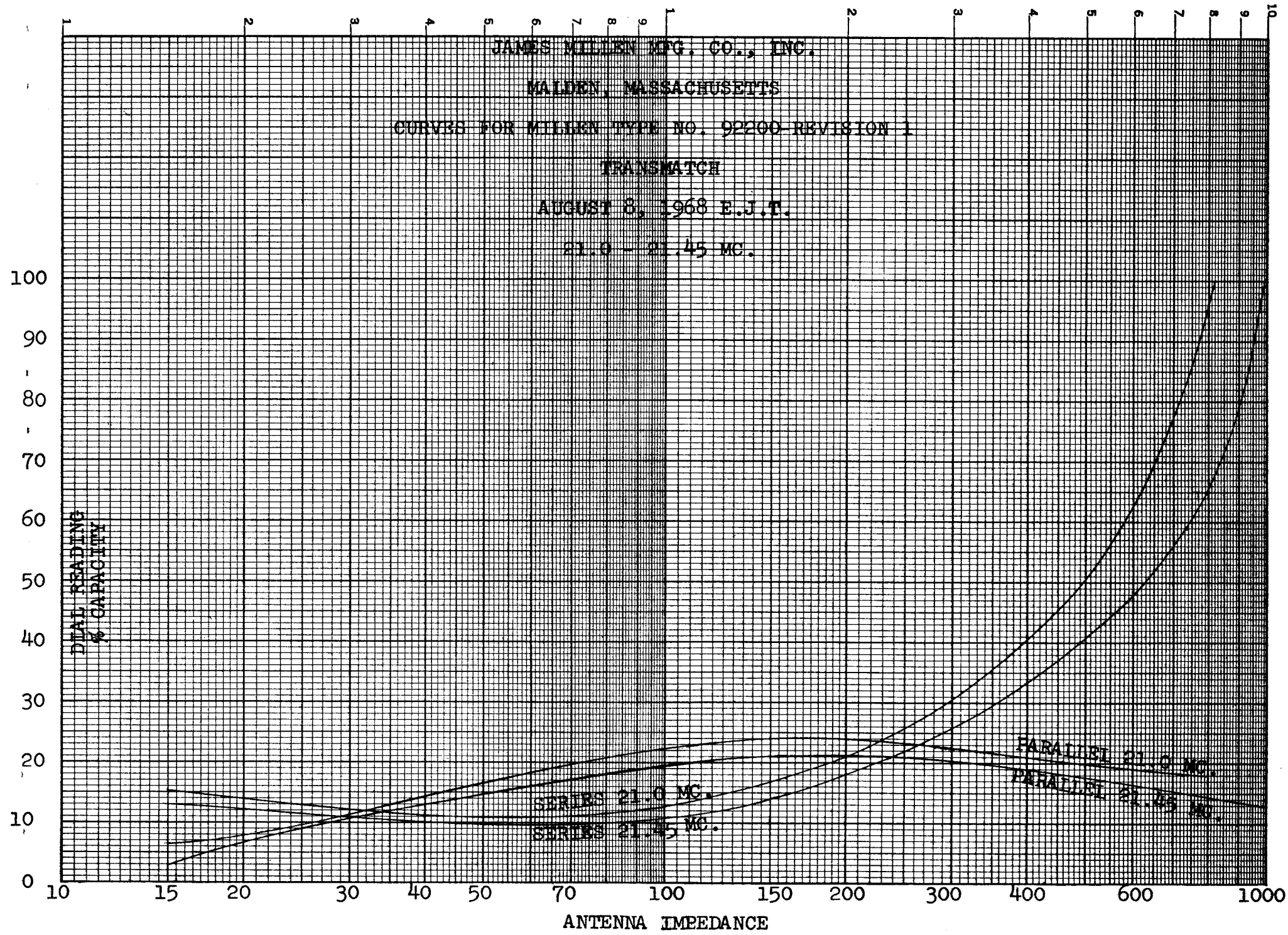


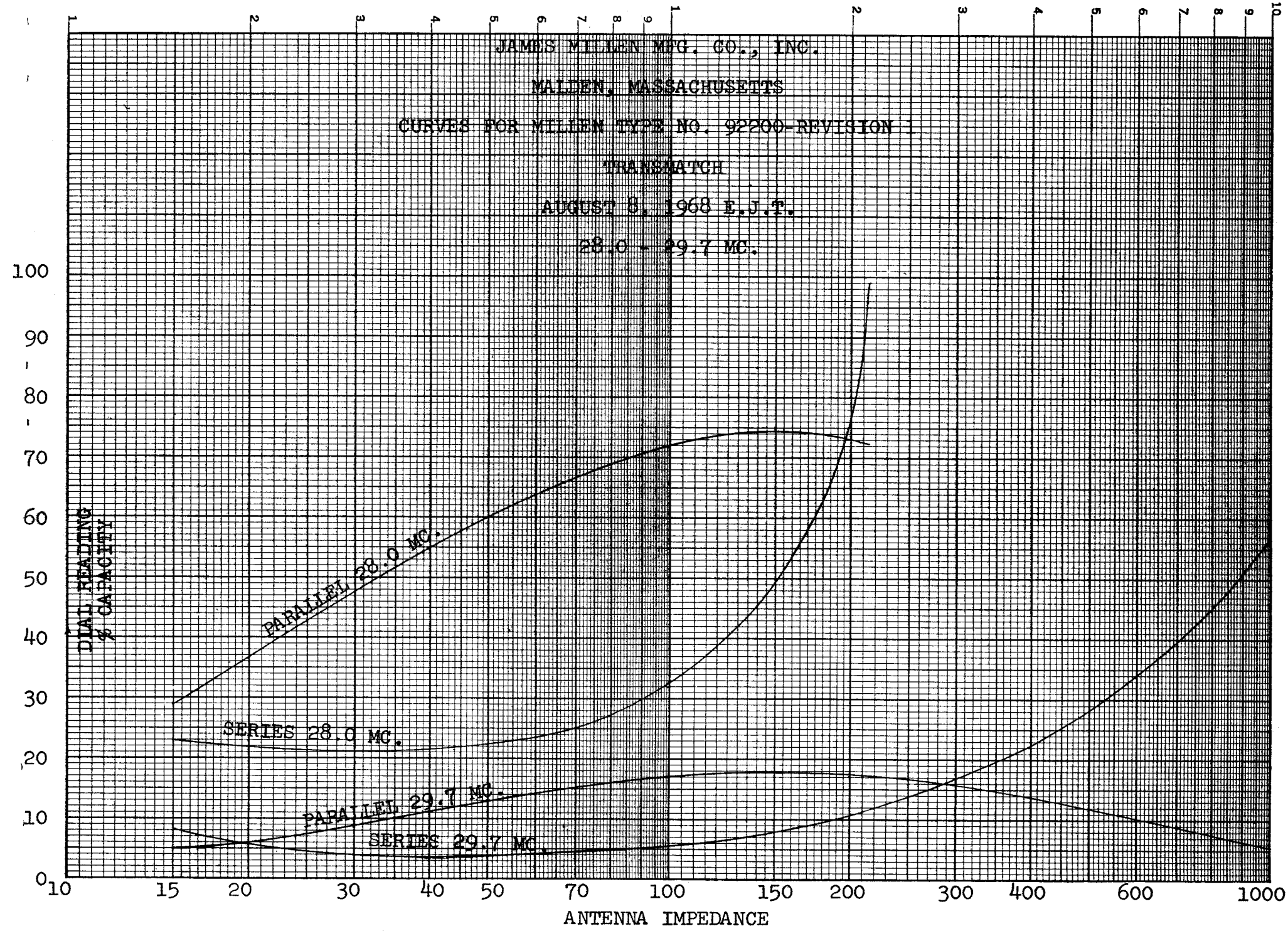




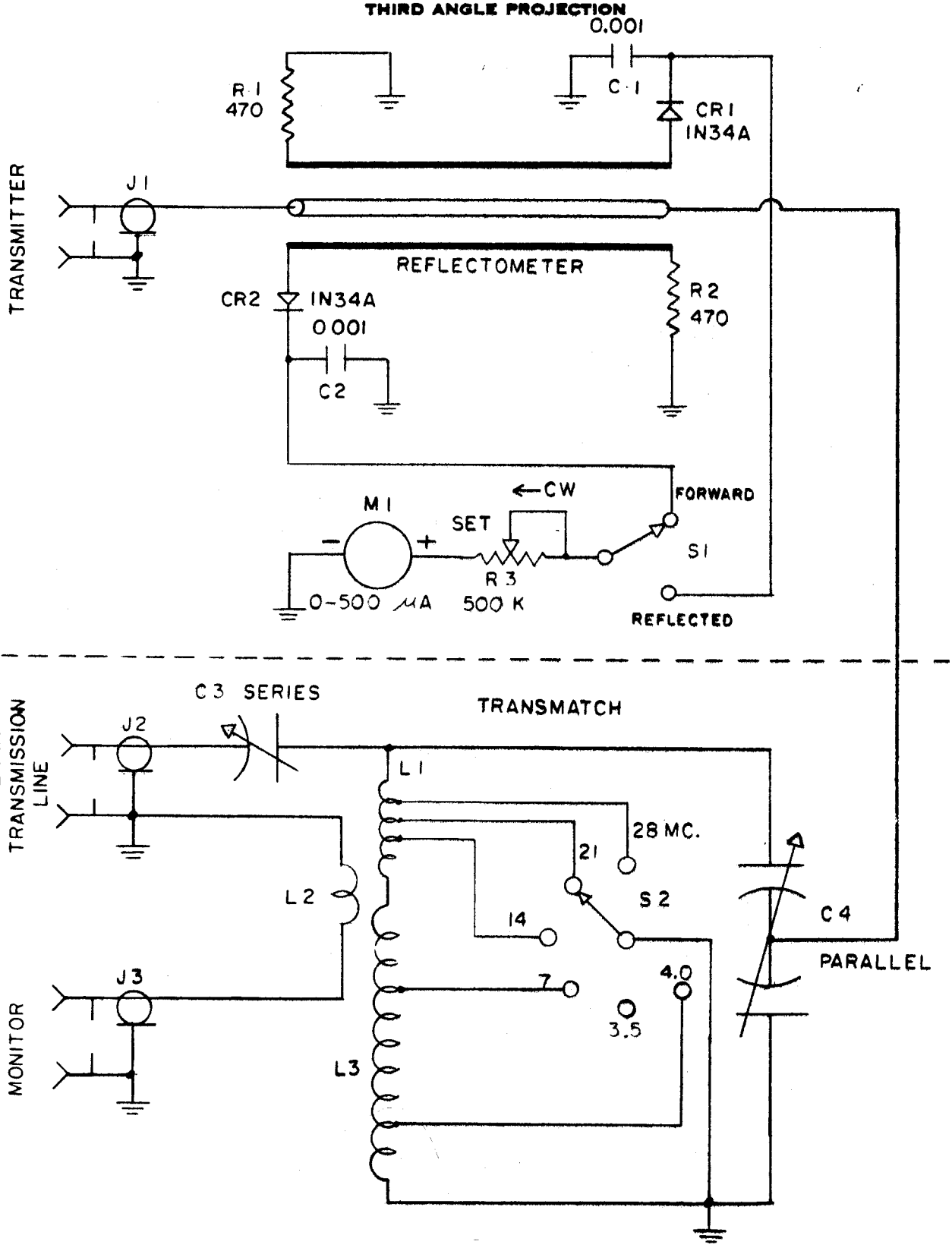








THIRD ANGLE PROJECTION



ALL DIMENSIONS UNLESS OTHERWISE NOTED MUST BE HELD TO A TOLERANCE OF

TRANSMATCH SCHEMATIC

FIRST MADE FOR

DESIGNED BY CGE | CHECKED BY CGE

DRAWN BY R.U. Thomas | APPROVED C.M.C.

JAMES MILLEN MFG. CO., INC.
MALDEN, MASS., U.S.A.

K92200-23

DATE 5-15-64

9-10-68	1	Ser.Nos. 483 and up
9-10-68 E.J.T.	1	ADD 4MC TAP. ADD 0-500μA CHANGE R3 TO 500 K